

Application Number 09/885,223
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AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (Currently amended): A method comprising:

receiving data packets from a plurality of links in one or more interface cards of a network device according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link;

prior to sequencing the data packets in the network device, performing a first routing operation to forward the data packets from the one or more interface cards to a multi-link service card of the network device in accordance with routing information that reflects a topology of a computer network, wherein the routing information identifies the multi-link service card as a destination for the data packets;

sequencing the data packets with the multi-link service card of the network device according to the multi-link protocol, wherein the multi-link service card of the network device facilitates support of the multi-link protocol by the network device; and

performing a second routing operation in accordance with the routing information to forward the sequenced data packets to the interface cards of the network device for communication over the computer network.

Claim 2 (Original): The method of claim 1, wherein the multi-link service card is not directly coupled to any of the links.

Claim 3 (Original): The method of claim 1, wherein the multi-link service card is integrated with one of the interface cards.

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Claim 4 (Original): The method of claim 1, further comprising:

sending the data packets from one or more interface cards to the destination device over multiple links according to the multi-link protocol.

Claim 5 (Original): The method of claim 4, further comprising, prior to sending the sequenced data packets to the one or more interface cards:

sending the data packets to the multi-link service card for fragmentation.

Claim 6 (Original): The method of claim 1, further comprising:

prioritizing the sequenced data packets to provide quality of service prior to sending the sequenced data packets to the interface cards.

Claim 7 (Currently amended): A method comprising:

receiving a set of fragments at a network device from a plurality of links in one or more interface cards according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link, the set of fragments collectively comprising an unsequenced data packet;

performing a first routing operation in the network device in accordance with routing information to send the fragments to a multi-link service card of the network device for sequencing, wherein the routing information identifies the multi-link service card as a destination for the data packets and wherein the multi-link service card of the network device facilitates support of the multi-link protocol by the network device; and

performing a second routing operation in the network device in accordance with routing information to send the sequenced fragments as a sequenced data packet to the one or more interface cards of the network device for communication to a destination device over a computer network.

Claim 8 (Original): The method of claim 7, wherein the multi-link service card is not directly coupled to any of the links.

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Claim 9 (Original): The method of claim 7, wherein the multi-link service card is integrated with one of the interface cards.

Claim 10 (Original): The method of claim 7, further comprising:

sending the fragments from one or more interface cards to the destination device over multiple links according to the multi-link protocol.

Claim 11 (Original): The method of claim 10, further comprising, prior to sending the fragments from one or more interface cards:

sending the fragments to the multi-link service card for fragmentation.

Claim 12 (Currently amended): A method comprising:

receiving a set of data blocks from a plurality of links in one or more interface cards of a network device according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link, and

performing a first routing operation in the network device to forward the data blocks from the interface cards to a first multi-link service card of the network device in accordance with routing information that reflects a topology of a computer network, wherein the routing information identifies the first multi-link service card of the network device as a destination for the data packets and wherein the first multi-link service card of the network device facilitates support of the multi-link protocol by the network device;

sequencing the data blocks in a the first multi-link service card of the network device; and

performing a second routing operation in the network device in accordance with the routing information to forward the sequenced data blocks back to the one or more interface cards.

Claim 13 (Original): The method of claim 12, wherein the data blocks are fragments, the method further comprising building a packet from the fragments in the first multi-link service card.

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Claim 14 (Original): The method of claim 13, further comprising fragmenting the packet in the first multi-link service card.

Claim 15 (Original): The method of claim 14, further comprising sending the fragmented packet to a destination device over a computer network.

Claim 16 (Previously Presented): The method of claim 12, wherein the first multi-link service card is not directly coupled to any links.

Claim 17 (Original): The method of claim 12, the method further comprising assembling the data blocks in a second multi-link service card.

Claim 18 (Previously Presented): The method of claim 12, further comprising prioritizing the data blocks in the first multi-link service card.

Claim 19 (Currently amended): A router comprising:

at least one one or more interface cards for receiving a set of data blocks from a source within a computer network according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link,

a multi-link service card that facilitates support of the multi-link protocol by the router, and

a routing control unit coupled to the interface card and the multi-link service card, wherein the routing control unit performs routing operations based on routing information to select the multi-link service sequencing card as a destination and to forward the set of data blocks from the interface card to the multi-link service card for sequencing according to the multi-link protocol, and wherein following sequencing by the multi-link service card, the routing control unit selects one of the interface cards to forward the sequenced data blocks over the computer network.

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Claim 20 (Original): The router of claim 19, wherein the routing control unit includes a packet forwarding engine coupled to the interface card and the multi-link service card.

Claim 21 (Original): The router of claim 20, wherein the routing control unit includes a interface card concentrator that couples the interface card and the multi-link service card to the packet forwarding engine.

Claim 22 (Original): The router of claim 20, wherein the routing control unit includes a routing engine coupled to the packet forwarding engine.

Claim 23 (Original): The router of claim 22, wherein the routing engine includes a routing table.

Claim 24 (Original): The router of claim 19, wherein the data blocks are data packets.

Claim 25 (Original): The router of claim 19, wherein the data blocks are data fragments.

Claim 26 (Original): The router of claim 19, further comprising a plurality of interface cards.

Claim 27 (Original): The router of claim 19, further comprising a plurality of multi-link service cards.

Claim 28 (Currently amended): The router of claim 19, wherein the routing control unit forwards sequenced data blocks to the multi-link service card for fragmentation according to the multi-link protocol prior to selecting one of the interface cards to forward the sequenced data blocks over the computer network, and wherein fragments of the sequenced data blocks are sent over the computer network via the interface cards following the fragmentation according to the multi-link protocol.

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Claim 29 (Currently amended): A router comprising:

a plurality of cards, wherein the cards include a first card for receiving data blocks from a computer network and a second card for sequencing the data blocks according to a multi-link protocol that allows multiple physical links to be treated by the router as a single logical link; and

a routing control unit coupled to the interface cards and the second card,

wherein the routing control unit maintains routing information that represents a topology of a network, and

wherein the routing control unit performs routing operations based on routing information to forward the data blocks from the interface card to the second card for sequencing according to the multi-link protocol and to forward sequenced data blocks from the second card back to the interface cards for output to network destinations.

Claim 30 (Original): The router of claim 29, wherein the data blocks are data packets.

Claim 31 (Original): The router of claim 29, wherein the data blocks are data fragments.

Claim 32 (Currently amended): A router comprising a plurality of cards, wherein the cards includes a first card for receiving data blocks from a computer network and a second card for fragmenting the data blocks according to a multi-link protocol that allows multiple physical links to be treated by the router as a single logical link; and

a routing control unit coupled to the cards,

wherein the routing control unit maintains routing information that represents a topology of a network, and

wherein the routing control unit performs routing operations based on routing information to forward the set of data blocks from the first card to the second card for fragmenting according to the multi-link protocol sequencing and to forward fragmented sequenced data blocks from the second card back to the first card for output to network destinations.

Claim 33 (Original): The router of claim 32, wherein the data blocks are data packets.

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Claim 34 (Currently amended): A multi-link service card for insertion within a network device, the multi-link service card comprising:

an electrical interconnection interface for coupling the multi-link service card to the network device,

an input logic unit that receives data blocks from a control unit via the electrical interconnection interface in response to a first routing operation by the control unit of the network device,

a sequencer unit coupled to the input logic unit for sequencing the data blocks according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link, and

an output logic unit coupled to the sequencer that sends sequenced data blocks for processing by the control unit with a second routing operation, wherein the multi-link service card facilitates support of the multi-link protocol by the network device.

Claim 35 (Original): The multi-link service card of claim 34, further comprising:

a memory logic unit coupled to the input logic unit and the output logic unit for storing at least part of the data blocks during sequencing.

Claim 36 (Original): The multi-link service card of claim 34, wherein the output unit fragments sequenced data blocks.

Claim 37 (Original): The multi-link service card of claim 34, wherein the input logic unit includes an input buffer, an unprocessed buffer and a parser.

Claim 38 (Original): The multi-link service card of claim 34, wherein the output logic unit includes an output buffer, a processed buffer and a fragmenter-assembler module.

Claim 39 (Original): The multi-link service card of claim 35, wherein the memory logic unit includes a memory device, a data memory control, and data state logic.

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Claim 40 (Original): The multi-link service card of claim 34, wherein the sequencer unit includes a reorder module.

Claim 41 (Original): The multi-link service card of claim 34, wherein the sequencer unit includes a packet builder for building packets from sequenced data blocks.

Claim 42 (Original): The multi-link service card of claim 34, wherein the sequencer unit includes a quality of service handler for prioritizing packets.

Claim 43 (Original): The multi-link service card of claim 34, wherein the sequencer unit includes a reorder module, a packet builder, a sequencer memory device, sequencer memory control and sequencer state logic.

Claim 44 (Withdrawn): A method comprising:

receiving data blocks from multiple links,
storing sequence numbers for the data blocks in data queues in the order the data blocks were received, the data blocks received from each link being stored in a unique queue assigned to the respective link, and
selecting sequence numbers from each queue in sequence to sequence the data blocks.

Claim 45 (Withdrawn): The method of claim 44, wherein the data blocks are data packets.

Claim 46 (Withdrawn): The method of claim 44, wherein the data blocks are data fragments.

Claim 47 (Withdrawn): The method of claim 44, further comprising polling head pointers of the queues for a particular sequence number.

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Claim 48 (Withdrawn): The method of claim 47, further comprising polling head pointers of the queues for sequence numbers less than the particular sequence number and declaring an error upon detecting a sequence number less than the particular sequence number.

Claim 49 (Withdrawn): The method of claim 44, further comprising:
storing the sequence numbers in a separate location from the data blocks; and
moving header information associated with the selected sequence numbers to a processed memory location.

Claim 50 (Previously Presented): A method comprising:
receiving data packets in one or more interface cards of a network device,
performing a first routing operation in accordance with routing information to send the data packets to a service card of the network device for prioritization; and
performing a second routing operation in accordance with the routing information to send the prioritized data packets to the interface cards of the network device for communication to a destination device over a computer network.

Claim 51 (Original): The method of claim 50, further comprising prioritizing the data packets by queuing the data packets according to header information.

Claim 52 (Original): The method of claim 51, further comprising maintaining multiple queues for a number of different bundles, wherein header information in the data packets includes information identifying a bundle and a priority.

Claim 53 (Previously Presented): The method of claim 1, wherein the interface card and the multi-link service card comprise removable cards that may be inserted and removed from the network device.